


1508712180



UNIVERSITY OF BRISTOL

MEDICAL  
LIBRARY



Digitized by the Internet Archive  
in 2015

<https://archive.org/details/b2144027x>



# OBSERVATIONS

ON

THE ARTIFICIAL MINERAL WATERS

OF

*D R. S T R U V E,*

OF DRESDEN,

PREPARED AT BRIGHTON:

*WITH CASES.*

---

By W. KING, M.D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, LONDON; LATE  
FELLOW OF ST. PETER'S COLLEGE, CAMBRIDGE.

---

BRIGHTON:

PRINTED AND PUBLISHED BY C. AND R. SICKELMORE, KING'S  
ROAD; AND MAY BE HAD ALSO OF S. HIGHLEY, 174, FLEET  
STREET, LONDON.

---

1826.

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

## P R E F A C E .

---

I NEVER had any experience of the effects of mineral waters till this establishment at Brighton was opened : I then read Dr. Kreysig's work with much attention ; and the impression made upon my mind was, that if any medicines could be found, either natural or artificial, to operate upon the constitution as he described these to do, they would be invaluable---they would enlarge our power of DOING GOOD, in a considerable degree. I began, therefore, to observe and study the effects of the waters, as a subject of great professional interest. I collected all the information I could from Dr. Struve, respecting the natural springs, and the history of his artificial preparations ; and his descriptions I cautiously compared with my own experience. I was soon gratified at finding that I had a new remedy in my hands, with which I could re-



lieve patients whom I was formerly obliged to dismiss as incurable. I am anxious to impress upon the reader, that the opinions I have expressed in the following pages, are the faithful results of experience and conviction; and not the wanderings of imagination, or the delusions of insincerity. To those who know me, this anxiety will be unnecessary; but it may give more confidence to those who are alike strangers to the subject and the author.

I have inserted the case of Dr. Struve among my own, as a matter of convenience; and I have connected with it the history of his investigations, and the rise of his establishments. I have omitted to state, that, besides drinking the waters, he received great benefit from using baths of Carbonic Acid Gas, at Marienbad, which issues from the earth, in some places, in great abundance, and can be easily collected and applied, by a proper apparatus.





# OBSERVATIONS

ON

## THE ARTIFICIAL MINERAL WATERS

OF

*DR. STRUVE.*

---

### CHAPTER I.

---

IT is not my intention, in the following pages, to write a treatise upon mineral waters in general, but to give to the profession and to the public, the result of my own experience of the efficacy of those artificial waters which are prepared at Brighton, and the medical conclusions to which it has led me. We have as yet had the opportunity of observing their effects for only one season. From a considerable number of cases, I have selected only a few of the most remarkable, and they are remarkable in a peculiar sense, for, with the exception of one, I am persuaded that our ordinary medicines would have given no relief whatever. Several of them had already baffled the skill of some of our most eminent physicians---

others had taken common medicines to no purpose, and others I should have thought it in vain to prescribe for at all.

In the practice of medicine, much may undoubtedly be effected by the judicious use of remedies known to the whole profession ; and much more may be accomplished by the exertion of superior skill and observation in a few highly gifted individuals : but still we have too much reason to lament the insufficiency of our art, both in renovating a weak constitution when unmolested by any specific disease, and in enabling it to throw off a local affection, or to recover from the effects of actual general indisposition. In such cases as these we sometimes know the kind of remedy we want, but we know not where to find it : and, when the patient will bear a candid opinion, we are obliged to confess our ignorance, and recommend him honorably to his own fortitude and patience.

To despair, however, of the discovery of new remedies, or of new applications of old ones, by no means accords with the conclusions we ought to draw from the experience of science, or with the modesty with which we ought to view our own information and powers. Unless the resources of nature were finite, and unless any one could presume that he possessed within himself the entire knowledge of every indivi-

dual in the profession, he would do wisely and justly to keep his mind still open to enquiry, ever ready to contemplate new truths, and to view old ones under new relations. Unless the invention of new remedies be an impossibility, which no one would be hardy enough openly to profess, we ought not only to hope for them for the sake of humanity, but to expect them as the natural fruits of the progress of science. The past century has witnessed the introduction of various new substances and preparations into our Pharmacopæias, and the single fact of the average increase of human life, is at once a high gratification to the practitioner, and a proof that our science keeps pace with others in the general progress towards perfection.

The remedies of which we are to speak are new in this country, and whatever may be their virtues at the natural springs, the form under which they are presented to us is also new. They seem, therefore, to come before us under a double disadvantage, which renders it more incumbent upon those who have witnessed their beneficial effects, to give the result of their observations to the public in an authoritative shape. For my own part, I have no hesitation in stating my opinion, that while they will not supercede the ordinary labours of the profession, they will prove a most valuable addition to its resources, as being peculiarly ap-

plicable to those diseases, over which we have at present little or no control. Of the nature of the cures performed at Carlsbad, we must in this country be almost entirely ignorant, because they are beyond the reach of most of our patients, and removed from the experience of the profession. Mineral waters, as remedies, can only be appreciated as others are, by actual experience and observation : and those who are removed from proper opportunities are as incompetent to decide upon their merits, as unprofessional persons themselves. However valuable a remedy may be, it still requires direction and management : the time, the quantity, the intermixture of other remedies, are circumstances only to be judged of by those upon the spot, who have made them the subject of their study. We cannot suppose that crowds of persons would continue to resort annually to certain springs, at great expense and inconvenience, without receiving any benefit beyond what exercise and change of air might account for ; or that medical men, allowed to be capable judges of the effects of other remedies, should be entirely mistaken in their opinion of these.

Dr. Kreysig, of Dresden, physician to the King of Saxony, who has devoted a long life to the study of his profession, has given his unequivocal testimony, not only in favor of the na-



tural waters of Carlsbad, but of the artificial ones prepared by Dr. Struve. He has even taken the trouble to record his sentiments in two small treatises, in which he has endeavoured to accomplish the difficult task of expressing the general results of his experience; in language intelligible to others who may not have enjoyed similar opportunities for observation. These works have been translated into English, but they do not do justice to the original, and therefore require to be studied, rather than read, with great attention and consideration, and with a certain degree of allowance for the phrases and expressions made use of. It appears also to me, that those only can appreciate their full value who have had some knowledge of the effects of the waters, as well as a large share of general experience.

The diseases in which the Carlsbad waters are most serviceable, are of a chronic kind; and the various forms of such diseases, in their simple state, as well as when connected with local affections, open a wide field of difficult inquiry. In England, by far the majority of our cases are acute, and when the immediate symptoms are subdued, should chronic consequences ensue, we are too often obliged to look on in a state of inactivity, rather superintending, in order to prevent fresh attacks and derangement, than actively employed in

restoring perfect health. We even see, occasionally, the slow but certain footsteps approaching of serious mischief, without the power of avoiding it. We search in vain for some remedy which may affect the constitution itself, and the actions of all its parts, which may give a new turn to all the vital processes, and renovate both the ORGANS and their FUNCTIONS.

To operate in this manner seems to be the peculiar property of the Carlsbad waters. They are ALTERATIVE, and *in a certain sense*, TONIC, for they seem to affect the system in the same way as alteratives do, by a gently purifying influence: and they gradually improve the strength, though not after the direct manner of the ordinary tonic medicines. The tonic effect is evidently the consequence of the alterative---for it is always the later of the two, and does not take place till the various functions of different parts are obviously improved. The alterative power seems to penetrate every organ and texture of the body, and to excite and regulate every secretion; while the tonic power seems to be the result of the restored healthy action of the body, similar to what takes place in a perfectly healthy constitution. In a healthy person, physical or animal power, is the result of the general health of the body. So these waters, by their alterative power,

restore every part of the body to a healthy state, and the effects of this are animal strength and vigour.

I should wish to make a few remarks upon the *modus operandi* of these waters, though I am aware of the difficulty of doing so without running into mere theory. It seems to me necessary, however, to hazard something on that point, which I might call the *PHYSIOLOGY* of the waters ; because, what I have to observe, is closely connected with the undoubted facts of their efficacy, and in the same degree in which my views are true, they will give consistency to the facts, and throw them under the form and authority of a science.

Though a mere speculative theory is unsatisfactory to a rational mind, and generally an enemy to the progress of sound knowledge, yet there can be no science till we have traced the connection of cause and effect, and generalized our facts.

The first perceptible consequences of taking the waters are very slight: they gently promote perspiration, and the flow of urine. These are their mildest effects. Perhaps, a person perceives the action of the bowels to be more regular and free, without being inclined to attribute it entirely to the water ; though, upon reflection, he becomes convinced, in a few days, that it is so. The appetite and spirits



improve in the same imperceptible manner---the nights are more composed and the sleep sounder and more refreshing---then an unusual determination to some part of the body seems to take place, which is described as if all the small vessels of the part were roused from a quiescent languid state, into one of activity ; this is accompanied by a sense of fullness and stretching, as if the parts might even give way : and when the head is thus affected, the sensation is oppressive and painful. These effects require watching ; if they pass on favorably, the disease is gone, the constitution renovated, and restored to vigour, strength, health and spirits.

The period during which these changes take place will vary considerably, according to the original constitution of the patient, and the nature of the disease.

I have seen some materially benefitted in two or three weeks, others in six or eight weeks ; while others may receive only partial benefit during that time, and have that benefit renewed as often as they repeat the waters. By the testimony of some who have drank the natural Carlsbad waters, as well as those in Brighton, I am informed, that this is the case : and Dr. Kreysig states, that some complaints will disappear after several courses of the waters in successive years.

From this history, it is evident that the waters do not act, or at least do not produce their decided effects, till they have entered the mass of the blood. It should seem, then, as if they altered and improved the qualities of the blood itself. We have been accustomed to the use of the phrases, "rich blood, poor thin blood, a large or small proportion of coagulum," &c. denoting certain changes in its sensible qualities. However difficult it may be to appreciate chemically the qualities of the blood, as connected with disease, there can scarcely be a doubt that there are different states and degrees of healthiness in it.

It must follow from this that the secretions of the body will be more or less healthy, as the secreting vessels and organs have a better or worse fluid to act upon. But the vessels, organs, and glands, themselves, are undergoing a continual change of structure, the materials of which structure are obtained from the blood. It is reasonable, therefore, to suppose, that the structure itself is so far dependent upon the materials of which it is composed, that the more perfect those materials are, the more perfect will be the structure and organization.

Again, there is superadded to every structure, a peculiar vital principle or power: upon

this the function of the structure depends. The structure of a part cannot be the cause of its life, because it may exist without life; but there is still a connection, relation, and dependency between them, so that the healthy action of each, depends in a degree, upon the healthiness of the other. The more perfect the structure is, the more perfect will be its vital principle. It may seem strange to speak of a vital principle as being more or less healthy, and more or less perfect: but, judging from its effects, we may be permitted perhaps, to use this language, as the best in which we can express certain facts which are allowed to exist. There is, then, a relation between the structure and the life; so that if we improve the structure, we improve also the vital power.

When a structure is endowed with life, it begins to perform its peculiar actions or functions, whether they consist in secretion, or absorption, or in contraction like the muscles, or in conveying information to the mind like the nerves. I conceive that the healthiness of the function, depends on the healthiness of the structure and the life connected with it; that if either of these be improved, the function will be improved; and, *a fortiori*, if both be improved, the healthy action of the part will be doubly improved. This is the way in which



the Carlsbad waters appear to act. They produce a succession of remarkable and important changes in the animal economy.

- 1.—They improve the qualities of the blood.
- 2.—They alter and improve the structure of the whole body, of every part, and of every organ.
- 3.—They improve the vital powers of each part and organ.
- 4.—They improve the functions of every part and organ.
- 5.—The result of all this is, in one word, **HEALTH**: the health of every part; and the health, tone, and vigour of the whole system, both of body and mind. Of this let those speak who have witnessed the effects—let those speak who have tried them. The medical world of London will soon have an opportunity of deciding for themselves, in the result of those cases in which they may prescribe these waters.

In the practice of medicine we are sometimes obliged to aid and assist nature, and sometimes to counteract her. It is seldom she can be thwarted with impunity. The most general of her laws, throughout all her kingdoms, is harmony; otherwise she would war against herself. The most able and judicious physicians, therefore, are those who study the laws of that harmony, and attempt to move in unison with them. Thus, where disease can best be controlled by diet and general management, and the patient will submit to it, we limit the interference of art to simple directions and natural remedies. Where new powers are re-

quired, we endeavour to confine ourselves to an alterative treatment, to enable the system itself to use its own powers, unassisted by art, as soon as possible. It is only in extreme cases, when nature herself seems to deviate widely from her own purposes, that we think ourselves justified in following her example, and in endeavouring to control her wanderings by those powerful weapons with which she herself has furnished us.

The value of the Carlsbad waters must increase, therefore, in estimation, when we find them approximating to the class of natural remedies: they act by assisting all parts of the frame, and offering violence to none.

Some persons have been incredulous as to the effects of mineral waters, from the small quantities of the substances held in solution by them: and, as improvement of health could not be entirely denied to those who had drank the waters, this has been attributed solely to change of air and more natural habits. They argue that the same medicines must produce the same effects, in all places, and therefore must act equally well when given from the shop, as when taken from natural springs. This argument comes, unnaturally enough, from some professional persons; and it will be worth while to examine and test it. It might be sufficient to reply, that it is an argument

altogether *a priori*, a mere *petitio principii*, not more untrue in fact, than unphilosophical both in premises and conclusion.

1. As to the quantity of substance in these waters, the Carlsbad and Eger contain about forty-two grains in a pint, and the quantity usually drank is from two to three pints. The Marienbad, which acts more readily upon the bowels, contains about seventy grains; and the Seidschutz, a simple purgative water, contains one hundred and thirty. But, as if to contradict the idea of the necessity of large quantities being essential to great effects, we find the latter water objectionable, as a constant remedy, since it produces the same flatulent and cholic inconveniences, when long continued, which follow the constant use of Epsom Salts, which enter largely into it.

2. In endeavouring to obviate the objection as to quantity, by increasing the draught, we are then turned round upon, and blamed for loading the stomach with such copious draughts of water; to which we can only oppose the fact, that if no evil arises, no evil exists. If the patients complain of no inconvenience, it is in vain for distant objectors to surmise that which never happens: and we may add, that this surmise also is a *petitio principii*.

3. As to the proportion in which some of the ingredients exist, it is no doubt extremely mi-

nute. What then? Is it a law of nature that minute doses can do nothing? This is contradicted by medicines which are in daily use: and, generally speaking, it is the last conclusion of matured experience, to prefer the ordinary use of small doses to large ones, in general practice. It is the young and rash practitioner, who anticipates success as he increases his doses, and despises, often to his cost and that of his patient's, the timid caution of older heads.

But when we look at the question dispassionately, we ought not to be surprised at the effects of mineral waters, considered in themselves. We find, in many cases, that the composition of several medicines in small doses, acts more favorably and effectually than larger doses of single medicines. We frequently have patients apply to us, who inform us that they require very large doses to act upon them---they have been taking them of their own accord, or have been prescribed for by others for a long time, but cannot find any thing powerful enough to excite the bowels. This is perfectly true---they have been over-dosed; and a milder treatment has immediately a favorable effect.

Again: the ingredients in these waters are numerous. Thirteen different substances exist in the Carlsbad waters; and the effect of the



compound may, from analogy, be fairly considered as superior to that of the individual ingredients taken separately.

There are also other circumstances to be considered : these waters are strongly impregnated with carbonic acid, a substance known to be peculiarly grateful to the stomach ; and the salts contained in the water generally exist in the state of bicarbonates.

In preparing common medicines, the carbonic acid which may be contained in the water, is first carefully driven off by boiling ; while on other occasions we afford full testimony of its efficacy, by preparing it in such a way, that it may be presented to the stomach in a state of effervescence.

In addition to this, the Carlsbad water is produced at a high temperature, and very little observation shews that this is a very important circumstance. The four springs of Carlsbad differ only in temperature, yet the effects upon the body are proportionably different. The hotter springs are more powerful ; so much so, that it is dangerous ever to begin with the hottest. Who would venture to argue, *a priori*, that the effects of medicine would vary as its temperature ? Certainly no one. But the importance of this circumstance alone, would throw every *a priori* sceptic into the shade.

I cannot help adverting here, to the well-

known fact, of the formation of nitrogen, in animals which live upon food which does not contain it. Nitrogen is at present known only as a simple substance, because it has never been composed, or decomposed; but, as it exists in animals who have not obtained it from without, it seems to be formed from within. This is an extraordinary instance of the wonderful powers of the animal economy, and should make us very modest in deciding upon the merits of remedies from the minuteness of their component parts, for it appears from this, that by the presence of some of them, entirely new substances might be formed, of which we might be entirely ignorant. Nay, it is even possible, if it be not probable, that during life, certain substances may be formed, which are dissolved again by death, and which must, therefore, necessarily, and for ever, elude human observation. We must, therefore, not argue from the premises of our own ignorance, or we shall come to a "most lame and impotent conclusion." We must first look steadily and faithfully at the facts, and then search for the proximate and general causes with patience and perseverance.

I cannot avoid mentioning here, another fact, to prove the important agency of extremely minute quantities of matter in chemical operations; from which, as the agency of

the principle of life, is still more subtle and refined, and different indeed in nature, we may think it more reasonable to give our faith to some matters, which may be said to be above our comprehension, but not contrary to it. A gentleman in London who had discovered a most beautiful dye for yellow color, when he came to apply it in practice, found it tarnished, which he attributed, upon examination, to the iron held in solution. When he employed distilled water the color was perfect---when he used common water its beauty was gone. He caused a well to be sunk through the different strata, till he came to the purest water, beneath the clay upon which London stands : in this he could detect no iron, by the most delicate chemical tests which are known. When, however, he came to dye his cloth, he still found a defect in the color---he could not obtain the same shade and brilliancy as when he employed distilled water---a proof that the water still contained iron, though in such extremely minute portions, as to be beyond the reach of all known tests.

I will here also mention, a wonderful instance of the extraordinary power of the Carlsbad waters, in altering the structure of the body. A Prussian General was going through a course of the waters : he had formerly had his arm broken in action, which had been set, and was

become perfectly strong. After drinking the waters some little time, he perceived that the fractured part of the limb became tender and loose. The absorbents had evidently taken away the bony deposit by which the union had been formed, owing to the active energies imparted to them by the waters. This effect was unfortunate for him; but it proves to us, the great power of the waters over the very structure itself of the body, and the important and radical changes which they are, therefore, capable of bringing about.

It is not necessary for our argument that every substance entering into the composition of the water, should be of known activity: it is sufficient that the whole compound is such. All we want is to have good assurance of the beneficial effects, by the testimony of competent observers. To take the ingredients separate from the compound, and argue their inefficacy in the compound, from their inefficacy when singly employed, is as unphilosophical as it is disappointing. It is by no means to argue *a pari ad parem*. In some of our celebrated ancient compound medicines, it has been the aim of some enquirers, and very properly so, to endeavour to ascertain the precise share of each ingredient in the general effect--the object was legitimate, as it was not directed against the compound, but merely an *indagatio*



*naturæ.* The result was, a more perfect knowledge of the qualities of the several substances, and indeed, in many instances, a simplification of the compound; but in many also, a conviction that the compound was more useful than its different parts when applied separately.

Some imitators of mineral waters have proceeded upon the principle of simplification; and though disappointed in the result, have not retraced their steps, to form a perfect resemblance. They have retained what they considered the leading and active ingredients, and omitted the supposed inert ones; and have then been surprised that a dissimilar compound should not produce similar effects.

As one instance of the error of this proceeding, we may cite the experience of Dr. Struve. In his first attempts to imitate the Carlsbad water, he had observed a small proportion of silex, about half a grain in a pint. Presuming, like others, that so small a quantity of a despised mineral could be of no consequence, he omitted it in his compound. He then observed that the taste of the iron was perceptible in his compound, but not in the Carlsbad. In considering to what cause this might be attributed, he imagined it might possibly be owing to the absence of the silex: he then recomposed the water accurately, according to the proportions of the silex as well as of the other substances,

and the iron was no longer perceptible. This fact was sufficient for his accurate mind---he no longer presumed to set up his conjectures in the place of facts, but adhered henceforth to the invariable rule, of including every part of the natural product in his composition, however trifling in quantity or reputedly inert in quality. To this faithful accuracy his extraordinary success is to be chiefly attributed, but not entirely ; for it required, in the first place, an accurate analysis, and in the second, a sufficient machinery. The first he supplied by operating upon unusually large quantities. Instead of a few pints, he employed one, and even two hundred : from these he obtained, first, the carbonic acid, by distillation, and then, the solid materials, by very slow evaporation. Thus, though the quantity of iron in a pint of Carlsbad, is only one-fiftieth of a grain, yet, in two hundred pints, it would be four grains---a quantity easily appreciated. That his analysis did possess an extraordinary degree of exactness, is proved by the independent testimony of Berzelius, whose results are the same : and, that the artificial waters of Dr. Struve present us with a compound precisely similar to the natural one, is proved by the analysis of one of the first of our own chemists, Mr. Farraday, to whom a quantity of the water was submitted for examination. Mr. Farraday informs me, that “ He obtained re-

sults approximating very closely indeed to those stated to have been obtained by Berzelius, from the Carlsbad waters. The differences were not greater than such as would be occasioned by the unavoidable errors of experiments on such minute quantities of matter."

It is well known how extremely difficult it is to hold mineral substances in solution, particularly iron, for any length of time. The Chalybeate of Tunbridge Wells, though very powerful at the spring, cannot be conveyed to London; and an eminent physician of the present day, is doubtful whether it can be drank with equal advantage even half a mile from the spring. Dr. Struve has overcome this obstacle by the ingenuity and perfection of his machinery, and can retain the solution perfect for many months.

In endeavouring to account for the efficacy of mineral waters, we ought not to overlook the state of minute division in which the particles of matter exist in them. The Carlsbad water contains about one scruple of Sulphate of Soda in one pint: our ordinary dose of this is about half an ounce, or twelve times the quantity. This we dissolve in at most two ounces of water---that is, the quantity of glauber salts contained in two ounces of common medicine, or one-eighth of a pint, is, in the Carlsbad waters, dispersed through twelve pints, or ninety-



six times as much fluid. Now when we know, from modern chemistry, that every single drop of fluid contains its proportion of the substance held in solution, and consider the physiology of digestion itself, as it regards the comminution and solution of food, we may reasonably infer that the minute vessels and absorbents concerned in digestion, will be more favorably disposed, if I may so speak, towards substances in such a minute state of division, than towards larger and grosser particles. The analogy appears to me to hold good between medicine and food. How well do we now know that there is a limit to the latter, beyond which, digestion will not take place at all; and within which, perfect digestion is almost in the inverse ratio of quantity? It was a happy phrase which Mr. Abernethy often employed in his lectures, that a diseased part must be "humoured," not irritated by unskilful, and, as it were, compulsory treatment. So the digestive organs must be humoured, both in food and medicine; one mode of which, is to present substances to their action in the gentlest possible way, and in the smallest possible quantities. The same medicine which, if given in small doses, will produce gentle and general perspiration, will, in larger quantities, produce dangerous convulsions and death. How often is the stomach so irritable, that we are com-

pelled to subdivide our doses, that they may be retained, and yet the strength of habit, in observing certain times for giving certain quantities of medicine, has not allowed us to generalize this fact, and to argue, that, in many cases a more refined mode of management might be attended with happier results. I do not mean to impeach the common practice of the profession as a general rule, but merely to point out the exceptions—to state the undoubted fact of the efficacy of mineral waters—to shew that it is in theory not only not unreasonable but most consonant to analogy, to use the great desideratum of a more refined pharmacy, in many cases—and to announce the welcome information, that, by the united aid of medical, chemical, and mechanical knowledge and ingenuity, a new and more scientific laboratory has been established for the preparation of medical remedies.

What, indeed, can be more rude, than the ordinary mode of preparing medicine? We generally take common water containing already various ingredients---we boil it, as if to get rid of its most useful part, carbonic acid---we then put in our various substances, either by infusion or coarse mixture, and the process is completed. Sometimes the quantity of solid matter is so great that no solution at all takes

place, but the mixture must be agitated at the moment of taking it, in order to equalize the portions of matter taken into the stomach. Let me not be understood to condemn this practice *in toto*, but only to point out the obvious fact of its rudeness, and, if I may so say, its unscientific nature, and the desirableness of something better. If we could vary our process according to circumstances, and in more difficult cases of disease, enable ourselves to combat more delicate and obstinate symptoms, by more refined, complex, and scientific preparations, we should confer an immense benefit upon society, similar to those which have at various times followed the past improvements in our art. Let us not too rashly deem this an impossibility, so as to prevent all attempts at discovery and invention. In a scrofulous constitution we all know the extraordinary effects of sea air and bathing ; yet not merely of that, but of the superiority of a dry bracing coast, over a moist, close, warm one, which is generally enervating. We now know also, that the Carlsbad and Pyrmont waters are very beneficial in such complaints. When these artificial preparations of them become established in public opinion, why may we not look forward to new preparations, upon similar principles, of substances already known to

possess great virtues ; and be blessed with far superior remedies, owing to superior methods of preparing and administering them ?

Here, however, I shall rest. It is not my object to theorize, but to affirm to the profession and to the world, the facts which have come under my own observation. If I have indulged in reflections which to others may appear far-fetched, it has been with a view to approximate towards a just theory, and to afford a motive and stimulus to exertion : for while some, in the warmth of their benevolent hearts, are anticipating, perhaps, too much for the earthly lot of man, others, though walking erect upon the solid ground reared by their ancestors, look round with cold and sneering scepticism upon the best-meant labours of their fellow creatures, to mend the deficiencies, and to improve and multiply the beauties of the spot on which they dwell. That those who are most deeply interested in the question, I mean the suffering and dejected invalid, will find out the value of the boon which is here proffered to him, I have no doubt ; nor do I hesitate to express my belief, that Dr. Struve has introduced among us one of the greatest blessings which this country has known in the present day. Those who had the pleasure of his acquaintance, could not but admire the simplicity and candour with which he communicated free-



ly the result of his studies; and those who have witnessed the powerful charm of his remedies in hopeless cases, where the friend, in the physician, could only lament over the insufficiency of his art, must ever pronounce his name with respect and veneration.



## CHAPTER II.

---

THE observations I have hitherto made are entirely the result of my own experience, of the efficacy of these waters. It will now be necessary to give some more direct account of the different waters themselves---the diseases in which they are esteemed most useful---and the precautions necessary in drinking them. This will be extracted chiefly from Dr. Krey-sig's Work, and from Dr. Struve, modified by my own experience, as far as its limited nature permits.

### I.---WARM WATERS.

#### *Carlsbad.*

There are four springs at Carlsbad which differ from each other only in temperature,

The Sprudel . . . . 165° Fahrenheit.

Neubrunnen . . . . 138°

Mühlbrunnen . . . . 128°

Theresebrunnen . 122°

The coolest are the mildest. Patients always begin with the mildest and proceed gradually

to the hottest. The hottest, if begun with first, would probably cause determination of blood to the head, and other unpleasant or even dangerous symptoms.

These waters operate upon the skin, the intestinal canal, and all the abdominal viscera ; augmenting the secretions and excretions. They are not, however, mere purgatives, but alteratives, changing and improving the whole assimilative process. Hence they are useful in all abdominal obstructions, whether of the liver, spleen, pancreas, or mesenteric glands.

They are efficacious in the cure of obstinate ague, jaundice, obstinate costiveness, hæmorrhoidal affections, some kinds of amaurosis, proceeding from abdominal obstructions, gallstones, and predisposition to form calculi or gravel in the kidneys and bladder ; in some cases of gout and chronic rheumatism, chronic cough and asthma from indigestion, in some cases of nasal polypus, and obstinate external ulcers ; in palpitation of the heart when not dependent upon deranged structure, in suppressed, irregular, or painful menstruation, fluor albus, and even more serious diseases of the uterus, provided they are not cancerous ; in cutaneous diseases, in nervous complaints originating in the abdominal organs, as hypochondriasis, hysteria, St. Vitus's dance, and catalepsy ; in the debility which often follows



measles and scarlet fever, and in counteracting the effects of some mineral poisons.

They are prejudicial in a hectic habit, in a tendency to apoplexy, in scirrhus and cancer, in syphilis, and generally in inflammatory complaints. Sometimes they may be used with advantage though local inflammation should exist, provided this does not affect the general system ; and provided the effects be carefully watched. The constitution may be gaining strength, while the local disease may be kept in check by topical applications, such as leeches, &c.

The patient commences with the water of low temperature, and with two or three glasses of six ounces each, which are increased gradually to six, eight, or ten, and sometimes more, according to the effects ; and the warm springs are exchanged for the hotter ones, as the disease seems to require. When the waters do not act upon the bowels, a small quantity of Carlsbad Salts are taken with them, or a glass or two of Seidschütz.

Generally, persons are restored to health in a gradual and almost imperceptible manner. In severer complaints no effects seem at first to follow from the waters : sometimes the disease appears to be aggravated ; a sense of lassitude, irritability, and fear, may come on ; after which these symptoms subside, the secretions and ex-

cretions become more regular and copious, and health gradually returns.

During the time of drinking the waters, cold and chills should be carefully guarded against, particularly while the waters are acting on the surface of the body in the early part of the day. The perspiration then induced, should be encouraged rather than checked; and if the patient expose himself to cold during that time, the consequences might be dangerous. It is for this reason, chiefly, that the waters are not drank in the winter; but, could a person observe these precautions, the waters would be beneficial in winter as well as summer.

During the course, great regularity and temperance must be observed in the diet and general habits: the food should be of the most digestible kind, and little or no wine or spirits should be drank.

A course may last from three to six weeks; and a second course may be taken during the season, after an interval of two, three, or four weeks. Some complaints may be entirely cured in one course---others may require a second or third---and some may find it necessary to drink the waters every summer, experiencing, during the rest of the year, a state of health which no other medicines can afford.

*Ems.*

There are two springs of the Ems water,

The Kränchen..... 117° Fahrenheit.

Kesselbrunnen..... 84°

They differ only in temperature, and either of them may be drank, as the patient prefers--- but the warmer is the more powerful, as with the Carlsbad.

These waters are very similar to the Carlsbad, but not so powerful: they have, for this reason, been called "The mild Carlsbad." They do not act so much upon the bowels, but more upon the skin and kidneys. Being less powerful than the Carlsbad, they are more prescribed in similar diseases occurring in weak delicate constitutions. They may also be used in some diseases of a doubtful kind, where the Carlsbad might be dangerous; particularly where tumours exist suspected to be scirrhus. As their operations are mild, they can be watched in such cases with more safety, and relinquished if the effects appear injurious. They will often strengthen delicate lungs, disposed to hæmoptysis, and some times ward off threatening consumption, when tubercles do not exist. They are useful in all cases where a scrophulous constitution exists, and particu-

larly for children where glands or joints are enlarged, and in rachitis. The quantity drank, the length of the course, and the precautions, to be observed, are much the same as in drinking the Carlsbad.



## II.---COLD WATERS.

### *The Kreutzbrunnen, of Marienbad.*

This water is not so decidedly alterative as the Carlsbad. It acts more immediately and more powerfully upon the bowels. It does not accelerate the circulation so much as the Carlsbad, and hence, is in less danger of producing determination of blood to the head, or any other part: it tends more to cool the constitution. It is, therefore, preferable when any inflammatory diathesis exists, as in CASE IX, and in full habits of body. It frequently acts as a mild aperient, while from its penetrating all parts of the body, it has some alterative effects, though they are less decided than those of the Carlsbad. The directions for drinking it, are the same as for the other waters.



*The Ferdinandsbrunnen, of Auschowitz, and the  
Franzensbrunnen, of Eger.*

These waters have a larger proportion of Carbonic Acid and iron, and a less proportion of Carbonate and Sulphate of Soda ; and hold an intermediate place between the Marienbad and the pure Chalybeates of Pymont and Spa. The alterative properties of these waters are less than those of the Marienbad, but greater than those of Pymont and Spa.---The Eger is a water much drank in Germany, and important cures are performed by it.

The quantity drank, and the precautions in drinking, are the same as in the Carlsbad.

*Pymont and Spa.*

These are purely strengthening Chalybeates : on this account they more nearly resemble common medicines. Their effect upon the system is, however, more powerful ; not from the quantity of their solid contents, but, probably, from the number of ingredients, their proportions, the mode in which they are combined, and the time and manner of drinking them. They assist the digestive organs and excite the sanguiferous and nervous systems ; they are useful in all cases of direct debility, where



no abdominal obstructions exist ; in the debility caused by severe diseases, as measles and scarlet fever ; by over-exertion of body or mind, or loss of blood ; in chlorosis, chronic diarrhæa, irregular menstruation, fluor albus, and in tendency to abortion from mere debility.

They are injurious in obstructions and indurations of the abdominal viscera, in hæmoptysis, in hectic habits and in apoplectic predispositions.

The Spa is very similar to the Pyrmont, but more gentle in its effects. The dose must be varied according to circumstances, but it is not carried to the same extent as the Carlsbad. The same precautions must be observed.

### *Seidschütz.*

These waters are gently purgative. They may be taken with any of the other waters, when the bowels are confined ; and are often useful preparatory to a course of any of the rest. The dose is from one to four glasses of six ounces each ; but, if taken for any length of time, it produces flatulence, and a slight cholic inconvenience. It is a cooling aperient. Sometimes, in very irritable stomachs, it is taken in the evening as well as the morning, in divided doses.

## CASES.

---

### CASE I.

DR. STRUVE had been engaged in examining the nature and properties of Prussic Acid. Having tried the effect of it upon himself, he brought on a paralysis of the left thigh and leg. (Vide Heidler über Marienbad, vol. 2, p. 13.) In order to obtain relief, he went to drink the waters of Marienbad, and was entirely restored to health. The benefit he received, so much greater than he expected, and the leisure afforded by his residence there, turned his attention to the general effects of the waters, and their chemical analysis. He was then led on to examine the medical and chemical properties of other German waters, in which research he employed several years. In 1820, he prepared an imitation of some of these waters, for his own use and that of a few friends. The effects of these imitations so nearly resembled those of the natural springs, and the benefit received by his friends was so decided, that many applications were made by other persons to be allowed

to drink the waters. In consequence of this, a public Pump Room was established at Dresden in 1821, at Leipzig in 1822, and at Berlin in 1823; since which time, one has been opened at Warsaw, and at Königsberg. Many hundreds of invalids have resorted to these institutions, in preference to the natural springs. This is the case at Dresden, though not more than eighty miles from Carlsbad---a proof of the estimation in which they are held: and many of the most able physicians of Germany, recommend the artificial waters, as being of equal efficacy with the natural ones.

---

## CASE II.

This is the case of a lady not thirty years of age, the mother of nine children. She was subject to violent palpitations, which had been attributed, by some French physicians, who had examined her by the Stethoscope,\* to an

---

\* This instrument consists of a cylinder of wood, thirteen inches long, and an inch and a half in diameter. A hole is bored through the centre, from end to end, about a quarter of an inch in diameter. One end is hollowed out in the shape of a cone, about an inch and a half deep, into which a piece of wood is fitted, which has a bore through

enlargement of the right ventricle of the heart. She had a dry, convulsive, and incessant cough, great tenderness of the epigastrium, the urine was thick, the bowels very confined, the feet swelled, and she was annoyed with erisipelatous eruptions in different parts of the body. She began drinking the Ems water, which was succeeded by the Mühlbrunn. When she commenced she was so weak, and the palpitations so violent, that she could not walk across the room without assistance. She improved gradually, and in less than two months all her symptoms disappeared. During the progress of her cure, she used a bath of the Ems water, which seemed to be attended with benefit. This case is the more remarkable, as Dr. Struve, at first, entertained very faint hopes of amendment.

---



---

the centre similar to that through the cylinder; so that when the piece is fitted on, it appears an entire cylinder. It may be used with or without the piece. By applying the hollow end to the chest, and the ear at the other end, the pulsation of the heart, both of the auricle and ventricle, may be distinctly heard; and those who are in the habit of using it, can determine, from the nature of the sound, whether any disease exists. Disease of the lungs may also be detected in the same way.



## CASE III.

A gentleman, about the age of forty-five, had been ill for five years with indigestion, flatulence, great debility, and wasting of the whole body. His countenance was sallow and desponding. He was subject to attacks of severe spasmodic pains, occurring in different parts of the body, but chiefly in the thorax and epigastrium: they came on suddenly; and, while they lasted, took away all power of moving. The body was excessively tender and irritable to the touch, so much so, that the very apprehension of being touched, and having the side examined, brought on a spasm of some duration. This would happen as often as five times during the day. The bowels were always in a state of costiveness---the motions dark, small, knotty, and scanty. He had been under the care of several eminent medical men, who relieved him for a time, but not effectually. He was going to Carlsbad, to try the waters, when a friend, who had been at Brighton, recommended him to try the artificial waters. The effect was most striking: in one week the spasmodic pains entirely ceased, his strength began to return, so that he could walk all over the town, his digestion and appetite improved, and his bowels became

quite regular. In three weeks he was perfectly well. The medicines which had previously done him most good, were alteratives and purgatives, to which these waters seem to be very analogous; though they produce their effects without the aid of mercury.

---

#### CASE IV.

A lady, about thirty years of age, had been ill for two years. She had had inflammation along the spine, attacking different parts at different times. This was treated in the usual way, with success. She had also had inflammation of the peritoneal covering of the liver, which had been subdued by leeches. She was left in a state of extreme debility. She could not move from her sofa, and was obliged to be carried to her carriage, when she went for exercise. If any attempt was made to raise the strength by tonics, they invariably brought back inflammation. The digestion was very weak---she could only live upon the mildest food---the bowels required medicine every day, in using which she was obliged to be left to her own discretion, as any trifling excess reduced her strength so much that it required several days to recover it. She began the

waters with great care and precaution, and gradually improved under them : in about two months she was able to walk about for exercise. The tonic qualities of the water did not re-excite the inflammatory disposition. At this time (April, 1826) she is perfectly well, and grown rather stout.

---

#### CASE V.

A lady, aged forty-five, had been under the care of an eminent London physician, for indigestion and irregular action of the bowels. She was so extremely nervous and hypochondriacal, that she could not speak without tears. She had not strength to stand for five minutes, and her whole body was in a constant state of trembling and agitation. Alteratives and tonics had been tried upon her without effect, and she came to Brighton in despair of finding any relief. After taking the waters about two months, she returned to town nearly cured---able to resume her usual occupations, and in a state of cheerfulness and comfortable feeling which she had not known for many years.

---

## CASE VI.

A farmer, aged forty-eight, had taken cold in the autumn of 1824: after the immediate effects were gone off, he grew gradually weaker, became thin and emaciated from having been stout, lost his appetite, had a constantly dry skin and feverish sensation, dry mouth, uncomfortable nights, frequent pulse, and low spirits. Various medicines were tried, to combat the irritation and restore the functions of the skin and digestive organs; but without much effect. I recommended him the waters, but living at some distance from Brighton, he dreaded the inconvenience of leaving his business, and hoped that some little benefit he had received from the medicines I had given him, might increase. At last, he consented to give them a trial, and so far improved under them as to go through the winter with ease and comfort, and to be able to follow his business. The probability is, that another course will completely restore him.

---

## CASE VII.

A lady, the mother of several children, had



been ill for fourteen years with indigestion, wasting, debility, and low spirits. Some tumour, at one time, seemed to be forming at the lower part of the abdomen, and some uterine affection was apprehended by her medical attendants. She spent a year in the South of Europe, and was partially relieved by it. Still she lived under constant alarm, about the state of her health, and the probable result.

By drinking the waters all these symptoms disappeared. Her spirits and strength returned in an extraordinary manner, the countenance assumed the ruddy appearance of health, she was able to take regular exercise, and walk about as well as before her illness.

---

### CASE VIII.

A young lady had been attacked with inflammation, supposed to be in some part of the mesentery. She was obliged to be put under the strictest antiphlogistic discipline: she was confined to the horizontal posture and perfect rest: leeches were repeatedly applied to the stomach, spine, and abdomen. After some months the symptoms were overcome: by degrees she was permitted to resume the erect posture; but for some weeks, was

too feeble to stand without assistance. As soon as she was able to journey, she came to Brighton. Her strength returned, though slowly; but, being advised to try the Carlsbad waters, her recovery became immediately accelerated, and in about six weeks, she appeared to have lost all traces of her severe illness.

---

### CASE IX.

A gentleman was subject to head-ache, arising from determination of blood to that part. He was occasionally cupped, with temporary, but not permanent, relief. Upon taking cold, he was attacked with a fixed painful affection of the foot, resembling rheumatism or rheumatic gout. In this state he continued some months: he then commenced drinking the Marienbad water. For three weeks he felt no alteration: at the end of that time, the bowels became strongly affected ---they sometimes acted thirty times in twenty-four hours. During this attack, instead of being weakened, he felt stronger and more cheerful. From that time his symptoms began to be relieved, and in another week he felt perfectly well. He had no return of pain

in the head or foot, up to the time of his quitting Brighton, a period of several months.

---

## CASE X.

A person, aged twenty-eight, fell, without any apparent cause, into a state of great debility, with loss of appetite, wasting of the whole body, and low spirits. It was evident, from the general state of his symptoms and appearance, and of the pulse, that he was threatened with consumption; though there was no cough or affection of the chest. I gave him some medicine to regulate the digestive organs, and to endeavour to control the circulation: not succeeding in the latter, as no actual mischief had appeared in the chest, I was desirous of observing the effects of the Carlsbad waters upon the system under such circumstances. For some weeks they appeared favorable: the appetite and strength improved, the countenance, particularly, became clearer and more healthy. The circulation, also, for a short time, became quieter. In the end, however, the disease again gained ground, and the patient gradually sunk under it. It is stated that these waters are generally injurious in con-

sumptions, but the use of this experiment was to convince me of the general power of the waters to benefit the system ; because they had this effect in spite of many unfavorable circumstances, just as we frequently succeed in relieving many symptoms with common medicines, though some incurable disease, whether latent or apparent, may prevent complete success and produce an unfavorable termination.

---

### CASE XI.

In the following case the nature of the disease was exceedingly obscure : at first it resembled organic disease of the heart ; but the improvement, under the use of the waters, either does not warrant this supposition, or proves that relief may be obtained even in such hopeless cases.

A lady who keeps a school, and is now fifty years old, had hooping cough at eleven years of age, very severely : she never perfectly recovered her health, but had constant pains in the chest, and cough. When she was sixteen, she caught cold, which brought on violent pain in the stomach, left side, shooting to the left shoulder ; convulsions came on, and continual faintings, as often as nine times a-day, with ge-



neral loss of power and a want of feeling in the left side. In this state of suffering she continued till she was forty-one; she was then seized with inflammation of the chest and bowels, and the spine was apparently affected. She had a seton in the back, and was six months in bed, unable to turn. She recovered enough to go into the country from London: she was then attacked with general fever, and lost the use of the lower extremities for six months. From this she recovered sufficiently to resume her occupations. At the age of forty-seven she was attacked with inflammation in the chest, accompanied by violent palpitations: the liver appeared involved in it, from the pain of the part and its disordered functions. In August, 1823, she came to Brighton, chiefly to try the vapour bath, from which she received some benefit. In 1824 she consulted me, when she complained of pain in the left side of the chest, but without cough. She was troubled with palpitations, violent pain in the back above the left kidney, loss of appetite, bad digestion, and irregular bowels; the secretions were bad and the extremities cold. She was cupped and leech-ed occasionally, both at the pit of the stomach and on the back, with some relief; and the action and secretions of the bowels were a little improved: but the benefit was so slight that I had no hope of their giving permanent relief.

In June, 1825, she began the Carlsbad waters, and continued them all the summer and autumn, occasionally intermitting them for a week or a fortnight. One of the first observations she made was, that her sight became considerably improved---though she had not been sensible of any defect in it, she now perceived it to be unusually strong and clear.

She described the effects of the waters to be, as if the small vessels were set in action all over the body, particularly about the heart. The perspiration of the whole body was increased and became regular, and the hands and feet, which had always been cold, became comfortably warm. The affected part of the back appeared rather to enlarge, for a time, and to be more painful ; but, by degrees, assumed a more natural state. The head felt full, but not painful---a very general effect of the waters. She was able to attend to her school with less fatigue, both of body and mind : she could stoop and pick up things from the ground, which she had been unable to do for many years.

In the course of the summer she had, what she called, one of her old bilious attacks ; which was, however, much milder than usual, and was followed with less debility. From this time a gradual amendment took place, and she is now in a very improved state of health : ne-

ver attacked with palpitations or shortness of breath, though still suffering some slight inconvenience in the left side of the chest, but not so great as to make her consider herself ill. The action of the bowels is regular, without the aid of medicine, and the secretions are much improved.

---

## CASE XII.

A lady had been afflicted, for some years, with general enlargement and dropsical affection of the abdomen, with tumours, probably in the ovaria, and of some of the abdominal glands, apparently, of a steatomatous character. She had been under the care of eminent physicians, but was gradually getting worse. She went to Carlsbad to drink the waters, and received some benefit. During the summer of 1825, she came to Brighton, to try the artificial waters: under their influence the tumours almost entirely disappeared. They first appeared slightly to enlarge and to soften, and then to diminish in size: her general health improved at the same time. She asserted that she could perceive no difference of effect or taste between these and the natural springs. These facts are supported by the authority of

Dr. Boisragon, of Cheltenham, whose patient she had been, who speaks in the highest terms of the efficacy of the waters, and pronounces them a valuable discovery.

---

### CASE XIII.

A young lady, aged fourteen, had been subject to epileptic fits from the age of four years; she seldom passed a day without them, and sometimes had four, and even five attacks, in twenty-four hours. Her parents had consulted several medical men, who had been unable to relieve her. They applied to me, and by attention to the digestive organs, the fits became less frequent: when, however, they did occur, they were more violent, as is commonly the case in that complaint. I wished to try the Carlsbad waters, though not very sanguine that they would benefit a disease so difficult to manage. If I entertained any hopes, they consisted in the absence of all signs of disease of structure, and in the simple though great debility of the patient. The length of time under which she had laboured under the complaint, had reduced her to a state of idiocy; her memory could retain nothing, even for a few hours; nor could she give a rational



answer to the simplest question. She drank the waters for three weeks: during this time she had but one attack, and that a slight one. The secretions and the digestion improved, the countenance became more intelligent, and the memory and mental faculties underwent a complete change for the better. She has now left them off some weeks, and has had no return. In such a disease, we dare not expect the cure to continue permanent---but more has been effected than could have been done by any other means; and we may reasonably hope, that a repetition of the waters will be attended with similar results in future. If the nervous system and vital powers can be brought to a certain pitch of strength, it is not unreasonable to suppose, that nature may take up the cure herself, as she does in all other cases when medical skill is of real avail.



### *Püllna Water.*

This should have followed the account of the other waters, but was accidentally omitted.--- It is a simply purgative water, more powerful than the Seidschütz, and preferable to it, be-

cause it produces no flatulence or other inconvenience. However there are cases in which the Seidschütz is better, whenever any degree of febrile action exists in the system.



NOTE to page 18, line 8.

In Thomson's Chemistry (vol. 4, p. 557, ed. 1824) is an account of some curious experiments, made by Vauquelin, upon the excrements of fowls, by which it appears probable, that both lime and phosphorous are formed in the digestive process of that animal; so that the vital powers of animals are capable of composing and decomposing substances which appear to us simple. To me, it does not appear at all wonderful, that life should possess such powers. If life did not possess powers higher than those of dead matter—higher than chemical and mechanical attraction, where would be the difference between dead and living matter; or the superiority of the one over the other?

FINIS.

#### ERRATA.

Page 13 line 11, for "HEATH," read "HEALTH."

Page 17 line 8, for "generally," read "united with carbonic acid, always."

Page 21, lines 19, 28, and 30, for "silex," read "silica."

Page 23, line 8, for "to hold mineral substances in solution, particularly iron," read "to hold in solution the carbonate of iron."

Page 33, line 5, for "only," read "chiefly."

TABLE of ANALYSES of the PRINCIPAL MINERAL WATERS of GERMANY, by Dr. STRUVE of Dresden.

Ingredients found in 16 ounces of Water in a dry state, in Grains.	CARLSBAD.	EMS.	MARIENBAD. <i>Kreutzbrunn.</i>	AUSCHOWITZ <i>Ferdinandsbr.</i>	EGER. <i>Franzensbr.</i>	PYRMONT.	SPA.	SELTERS.	SEIDSCHÜTZ	PÜLLNA.
Carbonate of Soda . .	9.695	10.750	8.26	6.197	5.00		0.7375	6.155		
Sulphate of Soda . .	19.869		39.72	22.544	25.50	2.14566	0.0375		23.4960	123.8
Muriate of Soda . . .	7.975	7.634	12.45	8.996	7.96		0.44949	17.292		
Sulphate of Potash . .		0.540	0.93		0.93	0.04194	0.07909	0.397	4.8940	4.8
Muriate of Potash . .		0.045						0.358		
Carbonate of Lime . .	2.37	1.1407	4.1300	4.016	1.847	5.98824	0.9850	2.1870	6.8060	0.77
Sulphate of Lime . .						7.22132			1.5050	2.6
Sub-Phosph. of Lime	0.0017				0.014		0.01366		0.0156	0.0035
Fluate of Lime . . . .	0.024	0.00192						0.0018		
Carbon. of Magnesia.	1.369	0.7887	3.0560	2.4	0.600	0.32352	1.12278	1.3780	1.0980	6.406
Sulphate of Magnesia						2.69752			83.1380	93.086
Muriate of Magnesia.						1.12664			1.6300	19.666
Nitrate of Magnesia .									7.9070	
Alumina . . . . .			0.0075							
Sub-Phosph. of Alum.	0.0024	0.0018				0.01478	0.00851	0.0027	0.0117	
Carbon. of Strontian.	0.007	0.0107						0.0192		
Sulph. of Strontian . .						0.02063			0.0463	
Carbon of Barytes . .		0.0029						0.0019		
Silica . . . . .	0.577	0.4139	0.8800	0.669	0.568	0.49689	0.4985	0.302	0.1200	0.176
Carbon. of Iron . . . .	0.0278	0.026	0.1760	0.4	0.350	0.42846	0.3751		0.0127	
Carb. of Manganese .	0.006	0.0037	0.0065	0.092	0.006	0.04852	0.0519		0.0042	
Carbonic Acid Gas } in 100 cubic in. }	58	51	125	149.56	154	160	136	130		
Temperature (Fahr.)	Spru. 165.° Neu. 138.° Müh. 128.° Ther. 122.°	Kessel. 117° Kränch. 84°	53.°	49.°	53.°	56.°	50.°	58.°	58.°	58.°
Solid contents. . . . .	41.9239	21.35932	69.616	45.314	42.775	20.55412	4.35903	28.0946	130.6845	251.3075
Authority . . . . .	Berzelius.	Struve.	Struve.	Steinmann.	Struve.	Struve.	Struve.	Struve.	Struve.	Struve.



THE UNIVERSITY OF CHICAGO

LIBRARY

PHYSICS

1891

1892

1893

1894

1895

1896

1897

1898

1899

1900

1901

















































































